

IN THE CLAIMS:

Please re-write the claims to read as follows:

Please cancel Claims 18-23 without prejudice.

- 1 1. (Currently Amended) A hierarchical memory structure for use in matching a
2 data string having a plurality of fields, the associative memory structure comprising:
3 a top-level associative memory; and
4 at least one next-level associative memory operably coupled to the top-level asso-
5 ciative memory so as to receive an output therefrom, wherein
6 the top-level associative memory is configured to receive and match one
7 or more of the fields of the data string and, in response to detecting a match, pro-
8 viding an output to the next-level associative memory, and
9 the at least one next-level associative memory is configured to receive and
10 match the output from the top-level associative memory plus one or more other
11 fields of the data string or one or more values derived therefrom and, in response
12 to detecting a match, outputting a result.
- 1 2. (Original) The hierarchical memory structure of claim 1 wherein the data
2 strings being matched are network messages.

1 3. (Original) The hierarchical memory structure of claim 2 wherein the one or
2 more fields input to the top-level associative memory include an Internet Protocol (IP)
3 address field.

1 4. (Original) The hierarchical memory structure of claim 1 wherein the top-level
2 associative memory and next-level associative memory are each ternary content address-
3 able memories (TCAMs) that support don't care values.

1 5. (Original) The hierarchical memory structure of claim 4 wherein the data
2 strings being matched are network messages.

1 6. (Original) The hierarchical memory structure of claim 5 wherein the one or
2 more fields input to the top-level associative memory include an Internet Protocol (IP)
3 address field.

1 7. (Original) The hierarchical memory structure of claim 1 wherein the output of
2 the top-level associative memory that is received by the at least one next-level associative
3 memory has a length that is shorter than a length of the one or more fields of the data
4 string that are input into the top-level associative memory.

1 8. (Original) The hierarchical memory structure of claim 7 wherein the length of
2 the output of the top-level associative memory is on the order of one-fourth or less of the
3 length of the one or more fields of the data string that are input into the top-level associa-
4 tive memory.

1 9. (Original) The hierarchical memory structure of claim 8 further comprising a
2 first memory structure associated with the top-level associative memory, the top-level
3 associative memory and first memory structure configured such that, in response to de-
4 tecting a match to an entry in the top-level associative memory, the top-level associative
5 memory specifies a location of the first memory structure containing the output that is
6 provided to the at least one next level associative memory.

1 10. (Original) The hierarchical memory structure of claim 9 further comprising a
2 message buffer for temporarily storing the data string, and buffer control logic for provid-
3 ing selected fields from the message buffer to the top-level and next-level associative
4 memories.

1 11. (Original) The hierarchical memory structure of claim 1 further comprising:
2 a first memory structure associated with the top-level associative memory, the
3 top-level associative memory and first memory structure configured such that, in re-
4 sponse to detecting a match to an entry in the top-level associative memory, the top-level
5 associative memory specifies a location of the first memory structure containing the out-
6 put that is provided to the at least one next level associative memory; and
7 a second memory structure associated with the at least one next-level associative
8 memory, the next-level associative memory and second memory structure configured
9 such that, in response to detecting a match to an entry in the next-level associative mem-
10 ory, the next-level associative memory specifies a location of the second memory struc-
11 ture containing information related to the matching next-level associative memory entry.

1 12. (Original) The hierarchical memory structure of claim 11 wherein the first
2 and second memory structures are random access memories (RAMs).

1 13. (Original) The hierarchical memory structure of claim 12 wherein the data
2 strings being matched are network messages and the one or more fields input to the top-
3 level associative memory include an Internet Protocol (IP) address field.

1 14. (Original) The hierarchical memory structure of claim 13 wherein the output
2 of the first RAM has a length that is shorter than the IP address input into the top-level
3 associative memory.

1 15. (Original) The hierarchical memory structure of claim 14 wherein the length
2 of the output of the top-level associative memory is on the order of one-fourth or less of
3 the length of the one or more fields of the data string that are input into the top-level as-
4 sociative memory.

1 16. (Original) The hierarchical memory structure of claim 4 further comprising a
2 plurality of records organized into common fields, wherein

3 at least one field of each record, which originally contained a corresponding
4 value, is replaced with a unique coordinate value (UCV) that has been generated for the
5 corresponding value, and

6 each UCV is shorter than the corresponding value that it replaces.

1 17. (Original) The hierarchical memory structure of claim 1 further comprising a
2 plurality of records organized into common fields, wherein

- 3 at least one field of each record, which originally contained a corresponding
4 value, is replaced with a unique coordinate value (UCV) that has been generated for the
5 corresponding value, and
6 each UCV is shorter than the corresponding value that it replaces.

Claims 18-23 (Cancelled)

Please add new claims 24 *et seq.*, as follows:

1 24. (New) A method for matching a data string, comprising:
2 providing a top-level associative memory;
3 coupling to the top-level associative memory an at least one next-level associative
4 memory, the at least one next-level associative memory receiving an output from the top-
5 level associative memory;
6 configuring the top-level associative memory to receive and match one or more of
7 the fields of a data string, the data string having a plurality of fields, and, in response to
8 detecting a match, providing an output to the next-level associative memory; and
9 configuring the at least one next-level associative memory to receive and match
10 the output from the top-level associative memory, and in response to detecting a match,
11 outputting a result.

1 25. (New) The method of claim 24, further comprising:
2 configuring the at least one next-level associative memory to further receive and
3 match one or more other fields of the data string, and in response to detecting a match,
4 outputting the result.

1 26. (New) The method of claim 24, further comprising:

2 using network messages as the data string.

1 27. (New) The method of claim 24, further comprising:

2 including an Internet Protocol (IP) address field in the one or more fields input to
3 the top-level associative memory.

1 28. (New) The method of claim 1, further comprising:

2 using for the top-level associative memory a ternary content addressable memory
3 (TCAM) that supports don't care values, and using for the next-level associative memory
4 a ternary content addressable memory (TCAMs) that supports don't care values.

1 29. (New) The method of claim 24, further comprising:

2 using network messages as the data strings.

1 30. (New) The method of claim 24, further comprising:

2 arranging the output of the top-level associative memory that is received by the at
3 least one next-level associative memory to have a length that is shorter than a length of
4 the one or more fields of the data string that are input into the top-level associative mem-
5 ory.

1 31. (New) The method of claim 24, further comprising:
2 arranging the length of the output of the top-level associative memory to have a
3 length on the order of one-fourth or less of the length of the one or more fields of the data
4 string that are input into the top-level associative memory.

1 32. (New) The method of claim 24, further comprising:
2 associating a first memory structure with the top-level associative memory; and
3 configuring the top-level associative memory, in response to detecting a match to
4 an entry in the top-level associative memory, to specify a location in the first memory
5 structure, the location containing the output that is provided to the at least one next level
6 associative memory.

1 33. (New) The method of claim 24, further comprising:
2 temporarily storing the data string in a message buffer; and
3 providing selected fields from the message buffer to the top-level and next-level
4 associative memories by a buffer control logic.

1 34. (New) The method of claim 24, further comprising:

2 configuring a first memory structure associated with the top-level associative
3 memory, such that, in response to detecting a match to an entry in the top-level associa-
4 tive memory, the top-level associative memory specifies a location in the first memory
5 structure containing the output that is provided to the at least one next level associative
6 memory; and

7 configuring a second memory structure associated with the at least one next-level
8 associative memory, such that, in response to detecting a match to an entry in the next-
9 level associative memory, the next-level associative memory specifies a location in the
10 second memory structure containing information related to the matching next-level asso-
11 ciative memory entry.

1 35. (New) The method of claim 34, further comprising:

2 using random access memories (RAMs) as the first and second memory struc-
3 tures.

1 36. (New) The method of claim 34, further comprising:

2 providing an output of a first RAM used as the first memory structure with a
3 length that is shorter than an IP address input into the top-level associative memory.

1 37. The method of claim 24, further comprising:
2 organizing the hierarchical memory structure into fields for storing a plurality of
3 records;
4 replacing at least one field, which originally contained a corresponding value,
5 with a unique coordinate value (UCV) that has been generated for the corresponding
6 value, and
7 making each UCV shorter than the corresponding value that it replaces.

1 38. (New) An associative memory apparatus to match a data string, comprising:
2 means for providing a top-level associative memory;
3 means for coupling to the top-level associative memory an at least one next-level
4 associative memory, the at least one next-level associative memory receiving an output
5 from the top-level associative memory;
6 means for configuring the top-level associative memory to receive and match one
7 or more of the fields of a data string, the data string having a plurality of fields, and, in
8 response to detecting a match, providing an output to the next-level associative memory;
9 and
10 means for configuring the at least one next-level associative memory to receive
11 and match the output from the top-level associative memory, and in response to detecting
12 a match, outputting a result.

1 39. (New) The apparatus as in claim 38, further comprising:
2 means for configuring the at least one next-level associative memory to receive
3 and match one or more other fields of the data string, and in response to detecting a
4 match, outputting the result.

1 40. (New) The apparatus as in claim 38, further comprising:
2 using network messages as the data string.

1 41. (New) The apparatus as in claim 38, further comprising:
2 means for including an Internet Protocol (IP) address field in the one or
3 more fields input to the top-level associative memory.

1 42. (New) The apparatus as in claim 38, further comprising:
2 means for using for the top-level associative memory a ternary content ad-
3 dressable memory (TCAM) that supports don't care values, and using for the next-level
4 associative memory a ternary content addressable memory (TCAMs) that supports don't
5 care values.

1 43. (New) The apparatus as in claim 38, further comprising:

2 means for using network messages as the data strings.

1 44. (New) The apparatus as in claim 38, further comprising:

2 means for arranging the output of the top-level associative memory that is
3 received by the at least one next-level associative memory to have a length that is shorter
4 than a length of the one or more fields of the data string that are input into the top-level
5 associative memory.

1 45. (New) The apparatus as in claim 38, further comprising:

2 means for arranging the length of the output of the top-level associative memory
3 to have a length on the order of one-fourth or less of the length of the one or more fields
4 of the data string that are input into the top-level associative memory.

1 46. (New) The apparatus as in claim 38, further comprising:

2 means for associating a first memory structure with the top-level associative
3 memory; and

4 means for configuring the top-level associative memory, in response to detecting
5 a match to an entry in the top-level associative memory, to specify a location in the first
6 memory structure, the location containing the output that is provided to the at least one
7 next level associative memory.

1 47. (New) The apparatus as in claim 38, further comprising:
2 means for temporarily storing the data string in a message buffer; and
3 means for providing selected fields from the message buffer to the top-level and
4 next-level associative memories by a buffer control logic.

1 48. (New) The apparatus as in claim 38, further comprising:
2 means for configuring a first memory structure associated with the top-level asso-
3 ciative memory, such that, in response to detecting a match to an entry in the top-level
4 associative memory, the top-level associative memory specifies a location in the first
5 memory structure containing the output that is provided to the at least one next level as-
6 sociative memory; and
7 means for configuring a second memory structure associated with the at least one
8 next-level associative memory, such that, in response to detecting a match to an entry in
9 the next-level associative memory, the next-level associative memory specifies a location
10 in the second memory structure containing information related to the matching next-level
11 associative memory entry.

1 49. (New) The apparatus as in claim 48, further comprising:
2 means for using random access memories (RAMs) as the first and second memory
3 structures.

1 50. (New) The apparatus as in claim 48, further comprising:
2 means for providing an output of a first RAM used as the first memory structure
3 with a length that is shorter than an IP address input into the top-level associative mem-
4 ory.

1 51. (New) The apparatus as in claim 38, further comprising:
2 means for organizing the hierarchical memory structure into fields for storing a
3 plurality of records;
4 means for replacing at least one field, which originally contained a corresponding
5 value, with a unique coordinate value (UCV) that has been generated for the correspond-
6 ing value, and
7 means for making each UCV shorter than the corresponding value that it replaces.

1 52. (New) An associative memory apparatus to match a data string, comprising:
2 a top-level associative memory;
3 at least one next-level associative memory coupled to the top-level associative
4 memory, the at least one next-level associative memory receiving an output from the top-
5 level associative memory, and the top-level associative memory configured to receive
6 and match one or more of the fields of a data string, the data string having a plurality of

7 fields, and, in response to detecting a match, providing an output to the next-level asso-
8 ciative memory; and

9 the at least one next-level associative memory configured to receive and match
10 the output from the top-level associative memory, and in response to detecting a match,
11 outputting a result.

1 53. (New) The apparatus as in claim 52, further comprising:

2 the at least one next-level associative memory further configured to receive and
3 match one or more other fields of the data string, and in response to detecting a match,
4 outputting the result.

1 54. (New) The apparatus as in claim 52, further comprising:

2 a network message used as the data string.

1 55. (New) The apparatus as in claim 52, further comprising:

2 an Internet Protocol (IP) address field included in the one or more fields
3 input to the top-level associative memory.

1 56. (New) The apparatus as in claim 52, further comprising:

2 a ternary content addressable memory (TCAM) used as the top-level asso-
3 ciative memory, the ternary content addressable memory (TCAM) supporting don't care
4 values.

1 57. (New) The apparatus as in claim 52, further comprising:

2 a ternary content addressable memory (TCAMs) that supports don't care values
3 used for the next-level associative memory.

1 58. (New) The apparatus as in claim 52, further comprising:

2 a network message used as the data string.

1 59. (New) The apparatus as in claim 52, further comprising:

2 the output of the top-level associative memory that is received by the at
3 least one next-level associative memory having a length that is shorter than a length of
4 the one or more fields of the data string that are input into the top-level associative mem-
5 ory.

1 60. (New) The apparatus as in claim 52, further comprising:

2 the output of the top-level associative memory having a length on the order of
3 one-fourth or less of the length of the one or more fields of the data string that are input
4 into the top-level associative memory.

1 61. (New) The apparatus as in claim 52, further comprising:

2 a first memory structure associated with the top-level associative memory, and the
3 top-level associative memory, in response to detecting a match to an entry in the top-level
4 associative memory, specifying a location in the first memory structure, the location con-
5 taining the output that is provided to the at least one next level associative memory.

1 62. (New) The apparatus as in claim 52, further comprising:

2 a message buffer to temporarily store the data string; and
3 a buffer control logic to provide selected fields from the message buffer to the
4 top-level and next-level associative memories.

1 63. (New) The apparatus as in claim 52, further comprising:

2 a first memory structure associated with the top-level associative memory config-
3 ured, such that, in response to detecting a match to an entry in the top-level associative
4 memory, the top-level associative memory specifies a location in the first memory struc-

5 ture, the location containing the output that is provided to the at least one next level asso-
6 ciative memory; and

7 a second memory structure associated with the at least one next-level associative
8 memory configured, such that, in response to detecting a match to an entry in the next-
9 level associative memory, the next-level associative memory specifies a location in the
10 second memory structure containing information related to the matching next-level asso-
11 ciative memory entry.

1 64. (New) The apparatus as in claim 63, further comprising:

2 a random access memory (RAMs) used as the first memory structure.

1 65. (New) The apparatus as in claim 60, further comprising:

2 a random access memory (RAMs) used as the and second memory struc-
3 ture.

1 66. (New) The apparatus as in claim 63, further comprising:

2 a RAM used as the first memory structure, the RAM having a length that is
3 shorter than an IP address input into the top-level associative memory.

1 67. (New) The apparatus as in claim 52, further comprising:

2 the hierarchical memory structure organized into fields for storing a plurality of
3 records;

4 means for replacing at least one field, which originally contained a corresponding
5 value, with a unique coordinate value (UCV) that has been generated for the correspond-
6 ing value, and

7 means for making each UCV shorter than the corresponding value that it replaces.